5.4 Electric Potential Energy

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See Table 5.4.1 for analogy between gravitational potential energy and electric potential energy of a charge in a uniform field (pg 187)

Uniform Field

Summary of formula

Electric Field Strength: $\vec{E} = \frac{\vec{F}}{Q_t}$

- $\vec{F}$ ← force felt by charge
- Q_t ← charge that is between plates in uniform field

$\left(\vec{E} = \frac{KQ_s}{R^2}\right)$

Electric Potential Energy (between // plates): $PE = Q_t \vec{E} d$ $\left(= \frac{1}{2}mv^2\right)$

$\Delta PE = Q_t \vec{E}(d_f - d_i)$

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Non uniform fields

- consider infinity to be our reference point, where $\vec{E}$ of the source charge is zero.
- so, Electric potential Energy (of 2 charges relative to infinity): $E_p = \frac{KQ_1Q_2}{R}$
- depending on charges, we get:

  "$+E_p$": ⊕ ⊕ or ⊖ ⊖ : repel naturally so it requires work to bring them together, and gains E_K as they move apart

  (... [illegible] when closer together)

move apart
(have more E_p when closer together)

"$-E_p$" : ⊕ ⊖ : attract naturally so requires work to separate them and gains E_k as they move together (have more E_p when separated more)

↑ gravity argument for why $E_p = $ "$-$" $\frac{GMm}{R}$

① ⊕⊖ $E_p = -10$

② ⊕ ⊖ $E_p = -2$

③ ∞ apart $E_p = 0$

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